

WHAT IS CLAIMED IS:

1. A soft Cr-containing steel having a composition, on a % by mass basis, comprising:

C: from about 0.001% to about 0.020%;

Si: more than about 0.10% and less than about 0.50%;

Mn: less than about 2.00%;

P: less than about 0.060%;

S: less than about 0.008%;

Cr: from about 12.0% or more to about 16.0%;

Ni: from about 0.05% to about 1.00%;

N: less than about 0.020%;

Nb: from about 0.30% to less than 1.00%;

Mo: more than about 0.80% and less than about 3.00%;

W: from more than about 2.00% to about 5.00%; and Fe and incidental impurities,

wherein the contents of alloying elements, silicon and molybdenum, represented by Si and Mo, respectively, on a % by mass basis, satisfy the following formula (1):

$$Si \leq 1.2 - 0.4Mo \quad (1).$$

2. The soft Cr-containing steel according to Claim 1, wherein the content of Mo is more than about 1.50% and less than about 3.00% by mass in the composition.

3. The soft Cr-containing steel according to Claim 1, further comprising, on a % by mass basis, at least one selected from the group consisting of Cu: from about 0.05% to about 1.00%, Ti: from about 0.02% to about 0.50%, V: from about 0.05% to about 0.50%, and B: from about 0.0005% to about 0.0100%.

4. The soft Cr-containing steel according to Claim 2, further comprising, on a % by mass basis, at least one selected from the group consisting of Cu: from about 0.05% to about 1.00%, Ti: from about 0.02% to about 0.50%, V: from about 0.05% to about 0.50%, and B: from about 0.0005% to about 0.0100%.

5. The soft Cr-containing steel according to Claim 1, wherein W comprises from more than 2.00% to no more than 3.00%.

6. The soft Cr-containing steel according to Claim 2, wherein W comprises from more than 2.00% to no more than 3.00%.

7. The soft Cr-containing steel according to Claim 3, wherein W comprises from more than 2.00% to no more than 3.00%.

8. The soft Cr-containing steel according to Claim 1, further comprising Al: from about 0.02% to about 0.50% by mass.

9. The soft Cr-containing steel according to Claim 2, further comprising Al: from about 0.02% to about 0.50% by mass.

10. The soft Cr-containing steel according to Claim 3, further comprising Al: from about 0.02% to about 0.50% by mass.

11. The soft Cr-containing steel according to Claim 4, further comprising Al: from about 0.02% to about 0.50% by mass.

12. The soft Cr-containing steel according to Claim 1, further comprising, on a % by mass basis, at least one element selected from the group consisting of REM: from about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

13. The soft Cr-containing steel according to Claim 2, further comprising, on a % by mass basis, at least one element selected from the group consisting of REM: from about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

14. The soft Cr-containing steel according to Claim 3, further comprising, on a % by mass basis, at least

one element selected from the group consisting of REM: from about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

15. The soft Cr-containing steel according to Claim 4, further comprising, on a % by mass basis, at least one element selected from the group consisting of REM: from about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

16. The soft Cr-containing steel according to Claim 5, further comprising, on a % by mass basis, at least one element selected from the group consisting of REM: from about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

17. The soft Cr-containing steel according to Claim 1, wherein regarding the state of Mo in the steel, a ratio of (112) diffraction intensity of the Laves phase, $(Fe,Cr)_2(Mo,Nb)$, to (111) diffraction intensity of Nb carbonitride, $Nb(C,N)$, A value = $I\{(Fe,Cr)_2(Mo,Nb)\}_{(112)} / I\{Nb(C,N)\}_{(111)}$, is less than 0.4 based on X-ray diffraction of extraction residues of precipitates in the steel.

18. The soft Cr-containing steel according to Claim 1, wherein the % by mass basis of Nb is from about 0.30% to about 0.70%.

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19. A soft ferrite structure, Cr-containing steel having a composition, on a % by mass basis, comprising:

C: from about 0.001% to about 0.020%;

Si: more than about 0.10% and less than about 0.50%;

Mn: less than about 2.00%;

P: less than about 0.060%;

S: less than about 0.008%;

Cr: from about 12.0% or more to about 16.0%;

Ni: from about 0.05% to about 1.00%;

N: less than about 0.020%;

Nb: from about 0.30% to less than 1.00%;

Mo: more than about 0.80% and less than about 3.00%;

W: from more than about 2.00% to about 5.00%; and
Fe and incidental impurities,

wherein the contents of alloying elements, silicon and molybdenum, represented by Si and Mo, respectively, on a % by mass basis, satisfy the following formula (1):

$$Si \leq 1.2 - 0.4Mo \quad (1)$$

wherein the steel has a ferrite single phase structure.

20. The ferrite structure, soft Cr-containing

steel according to Claim 19, wherein the % by mass basis of Nb is from about 0.30% to about 0.70%.

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21. An automobile exhaust system component, comprising a member made of a soft Cr-containing steel having a composition, on a % by mass basis, comprising:

C: from about 0.001% to about 0.020%;

Si: more than about 0.10% and less than about 0.50%;

Mn: less than about 2.00%;

P: less than about 0.060%;

S: less than about 0.008%;

Cr: from about 12.0% or more to about 16.0%;

Ni: from about 0.05% to about 1.00%;

N: less than about 0.020%;

Nb: from about 0.30% to less than 1.00%;

Mo: more than about 0.80% and less than about 3.00%;

W: from more than about 2.00% to about 5.00%; and

Fe and incidental impurities,

wherein the contents of alloying elements, silicon and molybdenum, represented by Si and Mo, respectively, on a

% by mass basis, satisfy the following formula (1):

$$\text{Si} \leq 1.2 - 0.4\text{Mo} \quad (1).$$

22. The automobile exhaust system component of Claim 21, wherein the component is an outer casing for a catalytic converter.

23. The automobile exhaust system component of Claim 21, wherein the component is an exhaust pipe.

24. The soft Cr-containing steel according to Claim 19, wherein the content of Mo is more than about 1.50% and less than about 3.00% by mass in the composition.

25. The soft Cr-containing steel according to Claim 19, further comprising, on a % by mass basis, at least one selected from the group consisting of Cu: from about 0.05% to about 1.00%, Ti: from about 0.02% to about 0.50%, V: from about 0.05% to about 0.50%, and B: from about 0.0005% to about 0.0100%.

26. The soft Cr-containing steel according to Claim 24, further comprising, on a % by mass basis, at least one selected from the group consisting of Cu: from about 0.05% to about 1.00%, Ti: from about 0.02% to about 0.50%, V: from about 0.05% to about 0.50%, and B: from about 0.0005% to about 0.0100%.

27. The soft Cr-containing steel according to Claim 19, wherein W comprises from more than 2.00% to no more than 3.00%.

28. The soft Cr-containing steel according to Claim 24, wherein W comprises from more than 2.00% to no more than 3.00%.

29. The soft Cr-containing steel according to Claim 25, wherein W comprises from more than 2.00% to no more than 3.00%.

30. The soft Cr-containing steel according to Claim 19, further comprising Al: from about 0.02% to about 0.50% by mass.

31. The soft Cr-containing steel according to Claim 24, further comprising Al: from about 0.02% to about 0.50% by mass.

32. The soft Cr-containing steel according to Claim 25, further comprising Al: from about 0.02% to about 0.50% by mass.

33. The soft Cr-containing steel according to Claim 26, further comprising Al: from about 0.02% to about 0.50% by mass.

34. The soft Cr-containing steel according to Claim 19, further comprising, on a % by mass basis, at least one element selected from the group consisting of REM: from

about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

35. The soft Cr-containing steel according to Claim 24, further comprising, on a % by mass basis, at least one element selected from the group consisting of REM: from about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

36. The soft Cr-containing steel according to Claim 25, further comprising, on a % by mass basis, at least one element selected from the group consisting of REM: from about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

37. The soft Cr-containing steel according to Claim 26, further comprising, on a % by mass basis, at least one element selected from the group consisting of REM: from about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

38. The soft Cr-containing steel according to Claim 27, further comprising, on a % by mass basis, at least one element selected from the group consisting of REM: from about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

39. The soft Cr-containing steel according to Claim 19, wherein regarding the state of Mo in the steel, a

ratio of (112) diffraction intensity of the Laves phase, $(\text{Fe,Cr})_2(\text{Mo,Nb})$, to (111) diffraction intensity of Nb carbonitride, $\text{Nb}(\text{C,N})$, A value = $I\{(\text{Fe,Cr})_2(\text{Mo,Nb})\}_{(112)} / I\{\text{Nb}(\text{C,N})\}_{(111)}$, is less than 0.4 based on X-ray diffraction of extraction residues of precipitates in the steel.

40. The exhaust system according to Claim 21, wherein the content of Mo is more than about 1.50% and less than about 3.00% by mass in the composition.

41. The exhaust system according to Claim 21, further comprising, on a % by mass basis, at least one selected from the group consisting of Cu: from about 0.05% to about 1.00%, Ti: from about 0.02% to about 0.50%, V: from about 0.05% to about 0.50%, and B: from about 0.0005% to about 0.0100%.

42. The exhaust system according to Claim 40, further comprising, on a % by mass basis, at least one selected from the group consisting of Cu: from about 0.05% to about 1.00%, Ti: from about 0.02% to about 0.50%, V: from about 0.05% to about 0.50%, and B: from about 0.0005% to about 0.0100%.

43. The exhaust system according to Claim 21, wherein W comprises from more than 2.00% to no more than 3.00%.

44. The exhaust system according to Claim 40,
wherein W comprises from more than 2.00% to no more than
3.00%.

45. The exhaust system according to Claim 41,
wherein W comprises from more than 2.00% to no more than
3.00%.

46. The exhaust system according to Claim 21,
further comprising Al: from about 0.02% to about 0.50% by
mass.

47. The exhaust system according to Claim 40,
further comprising Al: from about 0.02% to about 0.50% by
mass.

48. The exhaust system according to Claim 41,
further comprising Al: from about 0.02% to about 0.50% by
mass.

49. The exhaust system according to Claim 42,
further comprising Al: from about 0.02% to about 0.50% by
mass.

50. The exhaust system according to Claim 21,
further comprising, on a % by mass basis, at least one
element selected from the group consisting of REM: from
about 0.03% to about 0.10% and Zr: from about 0.05% to about
0.50%.

51. The exhaust system according to Claim 40, further comprising, on a % by mass basis, at least one element selected from the group consisting of REM: from about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

52. The exhaust system according to Claim 41, further comprising, on a % by mass basis, at least one element selected from the group consisting of REM: from about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

53. The exhaust system according to Claim 42, further comprising, on a % by mass basis, at least one element selected from the group consisting of REM: from about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

54. The exhaust system according to Claim 43, further comprising, on a % by mass basis, at least one element selected from the group consisting of REM: from about 0.03% to about 0.10% and Zr: from about 0.05% to about 0.50%.

55. The exhaust system according to Claim 21, wherein regarding the state of Mo in the steel, a ratio of (112) diffraction intensity of the Laves phase, $(\text{Fe,Cr})_2(\text{Mo},\text{Nb})$, to (111) diffraction intensity of Nb

carbonitride, $\text{Nb}(\text{C},\text{N})$, A value = $I\{(Fe,\text{Cr})_2(\text{Mo},\text{Nb})\}_{(112)} / I\{\text{Nb}(\text{C},\text{N})\}_{(111)}$, is less than 0.4 based on X-ray diffraction of extraction residues of precipitates in the steel.